CURRENT DRILLING AND STRUCTURAL STUDIES AT THE FLYNN CREEK IMPACT CRATER, TENNESSEE. David J. Roddy, U. S. Geological Survey, 2255 N. Gemini Drive, Flagstaff, AZ 86001.

A core drilling program is currently in progress at the Flynn Creek Crater in Tennessee to acquire subsurface structural and shock metamorphic data on flat-floored craters with central uplifts. This crater, approximately 360 million years old, was initially $\sim$ 3.8 km in avg. rim crest diameter ($\sim$ 3.5 km apparent) and $\approx$ 180 m in avg. rim crest depth ($\approx$ 80 m apparent) (1). Previous core drilling of six holes (762 m total) in the crater floor showed limestone and dolomite beds immediately below the base of the breccia lens (35 m avg. thickness) are intensely faulted and locally folded and brecciated, however deformation decreases downward and the strata is nearly flat-lying at depths of about 100 m below the base of the breccia lens (2).

The current core drilling program at Flynn Creek has been undertaken to improve definition of deeper structural deformation and shock effects in the inner rim, sub-crater floor, and central uplift regions. Over 1800 m of continuous core are now being drilled in holes ranging in depth from a few meters to about 700 m. Deep holes in the outer rim have provided structurally undisturbed comparative cores and critical thickness data for the entire stratigraphic section involved in the complexly deformed sequence under the crater. Core drilling completed in the outer crater floor area shows the strata underlying the breccia lens to be nearly 50 m lower than that in the adjacent inner rim and that the rocks are extensively faulted and locally brecciated. At depths of 350 m to 400 m in the same drill cores the relative displacement between sub-crater floor and inner rim strata decreases to less than 30 m. This type of deformation beneath the crater wall region is attributed to downfolding (as exposed in the overlying inner rim strata) and circumferential normal faulting, as at Sierra Madera (3) and Decaturville (4). This partially buried fold and/or fault zone appears to be essentially continuous in subsurface location as an extension of the major ring graben fault zone exposed in the southern and southeastern rims (2,5).

Preliminary reduction of the drill data from the central uplift indicates an abrupt transition from limited deformation in the rocks underlying the breccia lens on the crater floor to very complexly deformed rocks beneath the central uplift. Uplift, including extensive faulting and brecciation, beneath the flanks of the central uplift is over 130 m at a depth of 50 m below the level of the original crater floor. Uplift in this same region decreases to only 15 m at depths of 340 to 360 m below the original floor. Exposures in the top of the central uplift show a maximum uplift of Knox strata of about 450 m (5). The drill data confirm uplift is due, in part, to extensive faulting and brecciation beneath the uplift region creating a locally decreased mass/volume relationship. The ring fault and clear-cut inward movement of sub-crater floor strata also contribute to sustained uplift. The chill data completed to date suggest that the central uplift formed so rapidly that the large sequence of exposed Knox strata was violently uplifted over 450 m to form a massive detached block underlain by previously higher strata. The result appears to be a region of conical disruption with the character of a megabreccia zone, beneath the central uplift (5,6).

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Shatter cones have been previously identified in fine-grained carbonate rocks of the upper Knox strata exposed in the central uplift (2). Excellent shatter cones also now have been recognized at a depth of ∿ 406 m (below original pre-impact surface) in the drill cores in the same stratigraphic units exposed at the surface. Pre-impact depth of these rocks was ∿ 421 m below the original pre-impact ground level. A study of the orientations of the core axes is underway.

This drilling has been in progress since November 1978 and will be completed in March 1979. Recently a large body of deep drill data has been made available from other regional studies and will be incorporated into the structural, stratigraphic and shock metamorphic studies for the Flynn Creek Crater.

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